



Infrastructure Canada

Data Strategy

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Canada

Infrastructure Canada Data Strategy

Contents

Executive summary	1
Introduction	3
INFC's Vision for Data.....	4
INFC Data Strategy	5
Data Governance.....	10
People and Culture.....	11
Environment and Digital Infrastructure.....	12
Data as an Asset.....	13
Conclusion.....	14
INFC level of data maturity, near-term vision, and ideal state.....	16
References	17
ANNEX A – INFC Roadmap towards ideal state	18
ANNEX B – INFC's Business Landscape	20
ANNEX C – Detailed assessment of INFC Data Maturity.....	21
ANNEX D – Government of Canada Data Strategy Roadmap	22
ANNEX E – INFC Data Governance Model.....	23
ANNEX F – Using Data to Answer Use Cases.....	24

Executive summary

Infrastructure Canada (INFC) has an opportunity to further leverage its data assets through the use of human, financial and technical resources to achieve its mandate as efficiently and effectively as possible. The INFC Data Strategy presents a framework for the department to address these opportunities in the areas of data governance; people and culture; environment and digital infrastructure; and data as an asset. These thematic areas were purposefully used to ensure alignment with the Government of Canada's Data Strategy Roadmap (see below and Annex A for more detail).

Understanding infrastructure data and what constitutes infrastructure in a sub-national, national, and international context is complex. This can be seen more specifically through the example of the Canadian infrastructure deficit, which has been variously estimated to be between \$50 billion to \$570 billion.¹ Standardizing and defining data elements and concepts across the infrastructure ecosystem; putting these concepts and analysis into practice; understanding the role of the data culture through its people and partners; and supporting these actions with robust technical tools and systems will enhance evidence-informed decision-making and help to address the seeming complexities through greater understanding and use of infrastructure data.

Infrastructure Canada's Data Strategy

Provide the means by which staff, stakeholders and users can maximize the value of infrastructure data in Canada.

A key issue identified by INFC is the ability to effectively access, use or apply data to accomplish their work. One of the main data strategy goals for the department is to review, standardize, and catalogue data, and ensure systems and tools are in place to support information sharing and use across Canada's infrastructure networks. INFC will start building the foundation by: establishing data governance to provide business standards and priorities; creating a Data Steward committee to drive data management, and to establish measures, benchmarks and progress; and developing a metadata repository, with aligned business and technical metadata concepts and definitions, to document data standards. Key departmental milestones include:

Roadmap/Plan:

1. **2019-20** – Validate and finalize the data strategy; determine detailed work plans, define a data model; seek approval for an INFC data governance framework.
2. **Early 2020**– Improve data literacy within the department; explore viability of piloting more data sharing with provinces and territories; focus on elements for the development of a digital twin; and seek support for an overall data strategy implementation measurement framework.
3. **FY2020-21** – Assess the feasibility of a national infrastructure data advisory body; define data technology architecture and adopt INFC use cases; determine Key Performance Indicators (KPIs) and assess international standards.

¹ The Canadian Chamber of Commerce. The Foundations of a Competitive Canada: The Need for Strategic Infrastructure Investment. (2013)

4. **FY2021-22** – Expand and scale the data ecosystem; pilot shared data technology; and work to establish a toolkit for municipalities to improve data sharing of core master data
5. **FY2022-23** – Scale the shared solutions; establish an analytics centre of expertise; and expand the INFC data model to include external data and definitions.

Introduction

The importance of infrastructure in the Canadian context

Infrastructure touches the lives of all Canadians and is critical in creating an economy and society that benefits everyone. The impact of investments in infrastructure can be significant and far-reaching, from generating long-term economic growth, to creating resilient communities and a clean growth economy, to improving social inclusion and socio-economic outcomes.

Sound decisions are informed by strong evidence-based research and data. Yet Canadian infrastructure decision-makers are currently faced with a substantial infrastructure data gap. Many investment decisions tend to favour 'tried and true' approaches, which can be a barrier to successfully developing infrastructure that will meet the needs of tomorrow. More data, research and development is required, along with good program design and administration, if Canada's governments are to make smart, innovative infrastructure decisions and investments that will contribute to sustainability, economic growth, improved performance in key sectors such as construction, and solve major societal challenges.

The federal role in public and private infrastructure in Canada

The Government of Canada (GC) is one player in the infrastructure ecosystem. Given that the vast majority of public infrastructure nationwide is not owned at the federal level², the federal government's focus has been primarily on supporting the financing and delivery of infrastructure carried out by other levels of government. Increasingly, it seeks to further this role through the development of broad priorities, and advising on infrastructure projects.³

As a result, Infrastructure Canada (INFC) is a key player within the infrastructure ecosystem, with a vision to build Canada for the 21st century. In relative terms, INFC is a small department, with approximately 600 employees, but one whose role as a funder and enabler in infrastructure must be grounded in data and evidence. The key will be to continue to strengthen partnerships, programs and incentives that ensure information drives infrastructure decision-making. INFC aspires to be a catalyst for data and a support to others in realizing their successes.

Infrastructure Canada's Vision

Build Canada for the 21st century through a strategic and collaborative long-term infrastructure plan that builds economically vibrant, strategically planned, sustainable and inclusive communities.

² Based on Statistics Canada. Table 36-10-0096-01 Flows and stocks of fixed non-residential capital, by industry and type of asset, Canada, provinces and territories (x 1,000,000). Accessed September 3, 2019.

³ Statement of Priorities and Accountabilities – Canada Infrastructure Bank. Accessed: August 14, 2019.

INFC's mandate and business lines

INFC and its portfolio agencies work closely with various partners across the infrastructure ecosystem, including: provincial, territorial, and municipal governments and Indigenous communities (PTMI); private sector; and not-for-profit organizations to enable investments to ensure Canada has world-class, modern public infrastructure that addresses the complex challenges faced by Canadians every day. Such collaboration enables the department to deliver funding for infrastructure projects and foster knowledge and capacity building for improved asset management and evidence-based planning.

In addition to delivering its own programs, INFC is the lead department under the Investing in Canada Plan, responsible for the overall coordination and reporting on progress and results across 14 federal departments and agencies.

INFC's business landscape (see Annex B) needs to be supported by a Data Strategy. It is through this business perspective that the department must consider how and which data will support its mandate; its work with provincial, territorial, municipal and Indigenous partners; and, how to do so as transparently and effectively as possible.

Key risks and opportunities

In meeting its mandate and commitments, INFC faces certain risks: from those impacting internal management which challenge service delivery, to those which more directly affect our ability to implement key programs or convey meaningful investment results and outcomes.⁴ One of the key ways to mitigate these risks is the creation of a robust departmental Data Strategy, as it provides an opportunity to respond to these challenges through establishing and supporting governance, planning and reporting.

INFC's Vision for Data

Given INFC's role as a facilitator and partner, the department must benefit from the availability of good quality and well managed data. INFC sees opportunity to leverage, and enable others to leverage infrastructure and outcomes data as an asset, to ensure that decisions and investments are efficiently and effectively meeting the expectations of Canadians. To accomplish this, efforts to advance data initiatives need to be unified, both internally and externally across multiple partners.

To start, INFC needs to define the foundational data (sometimes known as "master data") held by stakeholders, and partners, including other federal government departments, which is relevant across many lines of work. In situations where the department is aware of data that could help advance its objectives, mechanisms for collaborating and sharing data need to be formalized. INFC would benefit from a modern digital and data platform that would allow the collection and storage of data from multiple sources,

⁴ <https://www.infrastructure.gc.ca/about-apropos/index-eng.html#1.2>. Accessed: August 14, 2019.

facilitate the access to the data for analytical purposes, provide a secure means to share and interoperate with our partners and recipients as well as Canadians. Through leading infrastructure data initiatives, INFC has an opportunity to catalyze improvements in the capture, standardization, and particularly, in the use of infrastructure data, in Canada.

By innovating and improving INFC's position with regard to data, and leading a culture of change, INFC will be able to more efficiently and effectively assess and report on the impacts of infrastructure investments in Canada. Individual branches, departments and organizations appreciate the interrelationships of their work, and through its Data Strategy, INFC aims to ensure maximum leverage of data as an enterprise asset, for all players in the infrastructure ecosystem.

Infrastructure Canada's Vision for Data

Promote and enable infrastructure and results data as an asset to maximize investment outcomes and strengthen INFC's role as a leader and catalyst in promoting and enabling infrastructure data needs across the broad ecosystem of decision-makers, funders, and owners/managers.

INFC Data Strategy

Background

The collection and use of data are critical for making sound decisions about current and future infrastructure priorities in Canada. In its role in enabling infrastructure investments in Canada, INFC must maintain a series of data holdings that intersect to allow for historical and future assessments of its programs and policies. To undertake this work, the department collects and uses the following statistics:

- Program- and project-centric data and information related to applications for funding and approvals, monitoring of program and project progress and expected results, supporting policy priorities and financial reporting and compliance, and ensuring open and transparent government results reporting;
- Survey and statistical program data developed through our partnerships, including those with Statistics Canada⁵ through key initiatives such as: Canada's Core Public Infrastructure Survey; the Infrastructure Economic Account; and the Enhanced Annual Capital and Repair Expenditures Survey; and
- Data and information to support innovative policies, programs and opportunities, internal and external communications, human and financial resources, and departmental financial planning functions.

⁵ First ever data from Canada's Core Public Infrastructure Survey and the Infrastructure Economic Account were published in 2018 while enhanced data, on the source of funding for infrastructure investments, from the Annual Capital and Repair Expenditures Survey are to be released in 2020.

INFC relies on data to provide insight and decision support across its business areas. For example, the department requires data to:

- Design programs and policies, and to ensure project proposals meet the criteria of funding programs;
- Enable corporate reporting functions, measure progress towards outcomes, and communicate results;
- Make decisions around financial administration and human resources planning;
- Monitor, evaluate and assess the relevance and performance of its policies and programs, and perform internal evaluations and audits to ensure sound risk management, control, and governance;
- Determine current and future trends for building economically vibrant, strategically planned, sustainable and inclusive communities;
- Leverage innovative approaches to address infrastructure challenges and attract investment; and,
- Respond to requests for data from stakeholders including federal, provincial and non-governmental partners.

INFC also faces issues related to the retention and privacy of data. These added dimensions of data management and access must be taken into account by the department to ensure ownership of their privacy responsibilities and, in turn, invest in the internal capacity, tools and processes necessary to satisfy these accountabilities. Putting in place the proper mechanisms and oversight will reduce the risks for data privacy and security as well as reduce any erosion of trust.

In order to understand its ability to provide the necessary supporting data for all lines of business, in early 2019, INFC engaged a third-party to establish an initial assessment of the department's data maturity. External consultants interviewed employees representing each of the department's business areas and concluded that INFC data management and usage is in its early stages of maturity, or "reactive" (see Annex C). While INFC was recognized as being better equipped to manage its program data, opportunities were identified to increase its overall infrastructure and results data management capabilities.

Purpose of INFC's Data Strategy

INFC's Data Strategy is relevant, adequately scaled and customized to its business framework. To support the department's vision and mandate, the planning, investing, and knowledge backing INFC programs and policies, its HR, finance, and communications should all be informed through data. INFC has aligned its strategy with the broader GC Data Strategy Roadmap, and addresses areas for immediate action outlined in the GC Data Strategy Roadmap (see Annex A).

In addition to INFC's data assets from programs and administrative sources, a great deal of data are being generated from new ventures like the Smart Cities Challenge and, eventually, the Canada Infrastructure Bank. The department also extracts value from data coming from other government departments, provinces and territories,

municipalities as well as surveys and programs in partnership with Statistics Canada (STC).⁶ The pace at which data are being created continues to increase.

INFC is not the custodian of all the data that it uses. However, it must ensure that, as the beneficiary of these data, it is using them as effectively as possible, in a way that is consistent with its business strategy, and that maintains the trust of Canadians while doing so. Further, given the wide breadth of partners in the infrastructure ecosystem, the department needs to ensure that everyone can leverage each other's efforts, and that everyone is speaking the same language when it comes to data. As an example, the infrastructure deficit is defined as being in the range of \$50 billion to \$570 billion⁷. This suggests there is quite a bit of work to do to understand what constitutes an infrastructure deficit; be it standardizing concepts, scope, or other gaps.

Planning and targeting programs is challenging at the best of times. A lack of precise information adds a layer of complexity which can be mitigated through better data which is clearly understood across the infrastructure ecosystem⁸. Fortunately, INFC has access to several forms of data from numerous sources mentioned above, and it is through capitalizing on the intersection points in a responsible and efficient manner that the department will realize the value of the information available which benefits its work.

The Department does not operate in isolation, therefore, actions taken to improve the Department's overall data maturity (in all four of the key pillars from the GC data roadmap) should drive improvements for the federal government as a whole, as well as for the broad ecosystem of infrastructure stakeholders. The table below presents the desired goal (the "what"), the drivers (the "why") as well as key steps that can be taken (the "how") to achieve outcomes across three different levels: the Department; the Government of Canada; and the infrastructure ecosystem. The sections that follow outline the vision and strategies for each of the Data Strategy pillars, which have been developed to support this multi-level lens, and which are further presented through a detailed roadmap, outlining how Infrastructure Canada will proceed over the short- to medium-term to achieve its objectives.

What	Why	How
Department Level: Ensure relevance and internal coherence, consistency, and security of INFC's data/information system	<ul style="list-style-type: none"> Ensure all branches are speaking the same (infrastructure, HR, finance, communications) language 	<ul style="list-style-type: none"> Assess INFC data and information (indicators, challenge function, data sources, concepts, definitions, etc.)

⁶ To date, INFC has partnered with Statistics Canada to launch Canada's Core Public Infrastructure Survey and the Infrastructure Economic Account, and will be receiving first-ever results from the enhanced Annual Capital and Repair Expenditure Survey.

⁷ The Canadian Chamber of Commerce. The Foundations of a Competitive Canada: The Need for Strategic Infrastructure Investment. (2013)

⁸ Although this speaks specifically to data to inform programs and policies, the same weakness will impact any domain, be it finance, HR or communications. Data providers and data users need to fully understand the concepts and sources of information to be able to use them effectively.

What	Why	How
	<ul style="list-style-type: none"> • Reduce manual intervention • Be able to take advantage of opportunities (Artificial Intelligence, Machine Learning) and support evidence-based innovation • Ensure efficiency and transparency in policy recommendations • Ensure coherence across INFCs Data Management Framework, Open Data and Information Release Plan, Performance Measurement Framework, and forthcoming digital Strategy 	<ul style="list-style-type: none"> • Use reference data within INFC data collection systems to reduce manual intervention and to increase efficiency, usability, utility, and reliability • Establish baselines and comparators for tracking comparative outcomes and experimental results • Evaluate investments and outcomes anchoring to reference data • INFC's Data and digital strategies are aligned to achieve the business outcomes defined in both
<p>Government Level: Ensure alignment, efficiency and security across the Government of Canada information/data system</p>	<ul style="list-style-type: none"> • Ensure consistent infrastructure "speak" (e.g., data definitions) across the federal family • Know the IT and subject matter expert requirements for data sharing (layers of virtualization) • Ensure INFC is able to efficiently play in the GC administrative data sandbox 	<ul style="list-style-type: none"> • INFC is the centre of expertise on infrastructure information/data • Representatives champion INFC's position and needs at GC Enterprise Data Community of Practice working groups (e.g., Reference data, EARB⁹, People and Culture, etc.)

⁹ Enterprise Architecture Review Board

What	Why	How
	<ul style="list-style-type: none"> • Reduce costs of data collection, processing and storage through use of common platforms, processes 	<ul style="list-style-type: none"> • Engagement and coordination nationally (e.g. Statistics Canada; ISED¹⁰ data regulations and policies and PIPEDA¹¹; Standards Council of Canada; National Research Council; Office of the Privacy Commissioner, etc.)
<p>Ecosystem Level: Facilitate alignment and security across the infrastructure information/data ecosystem (provinces, territories, municipalities, Indigenous communities, not-for-profit organizations, private sector, and internationally (e.g.: United Nations' sustainable development goals, International Organization for Standardization, etc.))</p>	<ul style="list-style-type: none"> • Common language use in the infrastructure space • In infrastructure information/data, federal government is a facilitator • INFC needs to meet GC obligations internationally • Inform strategies and regulations related to infrastructure investments as they evolve with and through data 	<ul style="list-style-type: none"> • Standardization through data catalogs and models – using reference data where possible (e.g. implement NAPCS¹² / NAICS¹³ right into INFC data collection platforms) • Engagement and coordination federally (e.g. FPT working groups, Nation-to-nation)

In alignment with the GC Data Strategy Roadmap, the sections that follow present INFC's vision and strategy for data management under the auspices of four key pillars:

1. Data Governance,
2. People and Culture,
3. Environment and Digital Infrastructure,
4. Data as an Asset

¹⁰ Innovation, Science and Economic Development

¹¹ Personal Information Protection and Electronic Documents Act

¹² North American Product Classification System

¹³ North American Industry Classification System

To support this Data Strategy, an INFC Roadmap has been developed which outlines concrete actions and timelines to be taken under each pillar to realize the department's vision.

Data Governance

Data Governance is the exercise of authority and control (e.g., planning, monitoring and enforcement) over the management of data assets. Its purpose is to ensure data are managed transparently and securely, according to policies and best practices, focusing on how decisions are made about data and how people and processes are expected to behave with respect to data.¹⁴

INFC's data governance model (see Annex E) will support the departmental Data Strategy by providing the framework under which decisions surrounding all forms of data are prioritized and approved. The following table summarizes INFC's position with regard to Data Governance.

Vision	Strategy
INFC has a mature data governance structure underpinning its Data Strategy	INFC will leverage and expand on the existing internal governance structure ¹⁵ to: <ul style="list-style-type: none"> • Facilitate the creation of an ecosystem of infrastructure data (catalog, model, etc.) • Prioritize the scope and lifecycle of the data resources that need to be managed; • Set policies, standards, reporting structures, and roles for data management, and ensure the monitoring and compliance; • Seek meaningful and broad input across the department and federal government; and, • Recommend data investment priorities.
Employees understand their roles and expectations in relation to data	INFC will articulate the roles and responsibilities of all employees including the Chief Information Officer (responsible for enterprise architecture and digital infrastructure), and a Chief Data Officer (an enabler of data as an asset) in an INFC data policy. The policy, which could be integrated into onboarding packages of all new employees, will guide employees on their roles and responsibilities with regard to data, as well as when and how to seek approvals for items outside of the scope of the Data Strategy, Roadmap, and Data Policy.
INFC as a leader in infrastructure	Engage Provinces, Territories, Municipalities, and Indigenous groups in discussions about information sharing; capacity building related to data and analysis; and reporting on results.

¹⁴ Data Management Body of Knowledge, 2nd Edition. DAMA International. 2017.

¹⁵ Infrastructure Canada Data Management Framework, Open Data and Information Release Plan, and Performance Measurement Framework 2016-2020. October 2018.

Vision	Strategy
related data and information	<p>Champion INFC needs via external governance bodies (see Annex E)</p> <p>Articulate INFC needs within the federal family at GC Enterprise Data Community of Practice working groups, ensuring key reference data for INFC are reflected in decisions</p>

People and Culture

The most important success factor for any organization is in its people and culture. If the people and culture are not convinced of a new way of thinking or doing, any new process is bound for failure. In promoting a change, articulating the benefit is key.

INFC has taken strides to adapt to a data-driven, open-by-default culture¹⁶, however, the department would benefit from a greater appreciation of data as an enterprise asset. No matter which branch or directorate generates data, each employee should recognize the power of harnessing and using data from multiple sources in their work. INFC aims to ensure employees are aware of the increased value that each individual's contribution will make when they are fully aware of and are incorporating information and data from various sources within and outside of the department in their day to day work. The following table presents INFC's position with regard to People and Culture.

Vision	Strategy
Data are used in briefing materials	<p>Adjust briefing templates to include a section on metrics/analysis as evidence to bolster the appreciation of measurement, quality data, and evidence-based decision-making.</p> <p>The absence of viable data to support a position or recommendation would indicate areas where potential issues exist in either data holdings, or in skillsets. These gaps are accounted for in future planning.</p>
Data skills are valued at all levels, business lines, and support functions	<p>Data skills are assessed and gaps are identified and targeted through employee learning, development and recruitment efforts for all employee categories, at all levels</p> <p>Training and recruitment needs are continuously identified, committed and tracked in employee's performance agreements and aligned with the maturity of the department</p> <p>Launch an INFC Data stewards or custodians working group in order to propose strategies and champion INFC's position on</p>

¹⁶ Ibid.

Vision	Strategy
	data in all branches with an initial focus on leadership for greater change management with regard to data.
Experimentation is supported to foster innovation and evidence-based decisions, based on robust data capabilities	Pilot initiatives and time-bound trials are embraced as experiments, used to fill data gaps around uncertain or new issues, and monitored with heightened and continuous attention to data in order to understand results throughout delivery (not just at the end).

Environment and Digital Infrastructure

Environment and Digital Infrastructure speaks to ensuring frameworks are in place which allow for data sharing, both through authorizations and technology. With an “open by default” position and an existing framework for Open Data, INFC is well situated to meet the requirements to share data. However, as the GC moves toward its digital strategy, INFC will be required to ensure its needs are met, both on a technical and subject matter level, and that it has the IT infrastructure to turn data and analysis into action. The following table presents INFC's position with regard to Environment and Digital Infrastructure.

Vision	Strategy
INFC is one of many data-driven departments and is easily able to access the data it needs, when it needs it	Processes and information technology ensure INFC has access to the data it needs, from the federal family (e.g., Memoranda of Understanding) INFC needs are articulated in the GC digital strategy as well as in protocols established by Treasury Board and STC
INFC has access to data management services and advice enabling the department to maximize the potential benefit of data	Scale the existing Data Management Framework, Open Data and Information Release Plan, and Performance Measurement Framework to future needs. Put in place a Digital and Data Platform (e.g., IT infrastructure) to support the Data Strategy as it matures, including: <ul style="list-style-type: none"> • accommodating an increased volume of data sources, • providing tools for data collection, ingestion, storage, analytics, visualisation and management

Data as an Asset

Data are indeed assets, with unique properties (e.g., usage cannot be depleted, do not depreciate in the same way), which need to be considered in their management. Understanding these properties leads to a greater understanding of their value.

INFC has been working closely with partners to champion increased quality, use, and availability of data across the infrastructure ecosystem. INFC is determined to expand its knowledge of existing data that can support the department's business, as well as on the potential value of combining department-held data sources with external sources.

When necessary, the department also engages external research services to address key knowledge gaps. For example, to further support sustainability objectives, INFC may seek to engage consultants to support the department's research and policy capacity in providing analysis and advice.

INFC's newest portfolio agency, the Canada Infrastructure Bank, was given a mandate to collect and disseminate data in collaboration with all orders of government, provide advice and act as a centre of expertise in order to support evidence-based decisions on infrastructure investments.¹⁷ This mandate is expected to complement INFC's ongoing data activities and fill important data gaps in the infrastructure space, particularly around projects involving private sector partners and revenue based models.

The below table summarizes INFC's position with regard to Data as an Asset.

Vision	Strategy
Data are used to support departmental reporting, for all purposes, and are coherent across all functions	INFC's Data stewards will: <ul style="list-style-type: none">• Evaluate INFC's reporting needs; explore and assess data sources, limitations, and options across the infrastructure data ecosystem.• Identify Critical Data Elements (CDEs) for use across the department.
INFC data holdings support multi-purpose use	Establish structures within INFC support the GC digital strategy to allow for maximum use of INFC's holdings. I.e., such that INFC can contribute to a GC data store. ¹⁸
Data are used to their fullest potential and properly managed	Assign data custodians or stewards within each business line
Data are not owned and the use, thought and management are not siloed.	Implement and use the term data stewards or custodians to break down barriers and allow for a more holistic approach to data as an organizational asset, which exists for the benefit of the entire

¹⁷ 2016 Fall Economic Statement; Budget 2017; CIB Act; 2017 Statement of Priorities and Accountabilities.

¹⁸ See activities of the GC Data Architecture Working Group as defined by TBS and Statistics Canada's Enterprise Community of Practice.

Vision	Strategy
	<p>organization. This will catalyze the idea that data are mutual assets, and decisions surrounding data should be taken with regard to their contribution to the department and infrastructure ecosystem.</p> <p>Establish a departmental committee of data stewards to champion the direction of data at INFC, with representatives participating in the various interdepartmental meetings</p>
Data is sought from external sources and INFC's portfolio agencies as necessary and available.	Where knowledge and information gaps exist within INFC, external sources and INFC's portfolio agencies are tapped to fill these gaps. This will better inform decision-making and help identify areas where INFC can continue to build its data collection.

Conclusion

What will success look like?

To achieve the department's data vision and strategy, INFC must work towards an ideal future state in all four of the key pillars as outlined in the GC Data Strategy Roadmap. A successful future state would ensure that:





- Data management plans, processes, guidelines and standards are established to address requirements for data usability, storage, access, and sharing, both within INFC and across partner organizations and the infrastructure ecosystem. A data inventory is in place to improve data discoverability and accessibility.
- Stakeholders and users are engaged through working groups to advance data collaboration and sharing. Partners within the infrastructure ecosystem are enabled to advance data initiatives to meet longer-term objectives, and their efforts generate data that is open and of benefit to all Canadians.
- There is a general awareness, commitment and support for the Data Strategy from within the department. INFC and other partners extract value from data assets to meet various business use cases (see Annex F). Data custodians consider and understand the relationships between their work and other branches of the department, and externally. Changes to programs are governed in consideration of impact to partners.
- Proper governance structures are in place to approve on the scope of the work, to prioritize deliverables, and to ensure that data related decisions consider INFC's goals and business strategy.

How will we get there?

INFC's Data Roadmap (ANNEX A) outlines what's achievable by INFC over the next three years. The steps established in this plan seek to address areas for immediate action, as identified in the Data Maturity Model Assessment (Gartner) and anchored through the pillars of the GC Data Strategy Roadmap. This Data Roadmap will position the department in achieving the desired outcomes at all levels (i.e., department, government, and ecosystem). INFC will revisit the Roadmap regularly to take stock of progress and introduce new steps and objectives, as the data and technology landscapes evolve.

In addition to the Roadmap, INFC will develop a Data Policy, which will articulate the function of data within INFC's business landscape, as well as the roles and responsibilities of all employees, with regard to data.

INFC level of data maturity, near-term vision, and ideal state

GC Pillar	Building Block	Level 1 Aware	Level 2 Reactive	Level 3 Proactive	Level 4 Managed	Level 5 Optimized
 DATA AS AN ASSET	Vision	Data is a source of power, but managed in silos.	IT attempts to formalize objectives for data availability, but hampered by organizational factors.	Cross-functional data accessibility encouraged by management, and improvements emerge.	Data quality best practices promoted, with data assets leveraged seamlessly across programs.	Data quality is integral to business strategy and architecture, and is leveraged across all programs.
	Strategy	Data is seen merely as application-specific.	Value of data recognized, and it is shared on cross-functional projects.	Sponsor named (e.g., Chief Data Officer), with a broad agenda, including funding and roadmap.	Well-funded and well-led data program addresses most enterprise needs (current and planned).	Data and analytics leadership has a say in corporate strategy.
 GOVERNANCE	Metrics	Goals and measures for data management and delivery are subjective and rarely, if at all, tracked.	Simple cost / benefit models used to justify investments, or are a part of other IT-business projects.	Qualitative measures for data management emerge, but may not link well to business KPIs.	Measures of data value and risk are developed, tracked, and communicated.	Data metrics are linked to business value, while data value and yield (e.g., ROI) models drive investments.
	Data Governance	Few official policies exist for the handling or use of most data, other than those required by regulations.	Policies have emerged for Data management but are not monitored and are regularly circumvented.	Policy adherence procedures for key data assets are developed and monitored.	An enterprise data governance organization is functioning and carries sway on all projects.	Enterprise data governance is encoded into an automated data asset management system.
 PEOPLE AND CULTURE	People	Data-related responsibilities are resourced on a project-by-project basis.	Pooled or centralized database administrators, data administrators and data modeling resources emerge.	Formal data and content management organizations materialize.	Data management moves outside of IT as a CDO is installed.	The CDO oversees and has authority and budget for most aspects of the data life cycle.
 ENVIRONMENT AND DIGITAL INFRASTRUCTURE	Processes	There is no understanding of data having its own life cycle.	Data integration is effective in linking data, but efforts to align and form shared procedures are sporadic.	Data flows are well-documented, but not maintained.	Enterprise MDM is an ongoing initiative that helps coordinate and enable business initiatives.	Information architects are embedded in the business and are key players.
	Technology	Data management, storage, and processing capacities are overloaded and almost entirely application-specific.	Infrastructure limitations and backlogs, as well as data silos, inhibit business performance.	Inventory of technologies exists and is maintained. Separate operational, content, and analytics environments exist.	A purely centralized infrastructure has given way to integrated, standardized, extensible, and IT-supported environments.	Infrastructure is dynamically elastic, served by purpose-built platforms, and shared across business units and partners.

Source: Gartner Data Management Maturity Assessment. Level 2 has been identified as the "average" position of INFC, along with the department's near-term and ideal vision.

INFC Overall Maturity Level (based on Gartner)

INFC near-term vision (2020-21)

INFC ideal state (2022-23)

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ANNEX A – INFC Roadmap towards ideal state



INFC Data Strategy is delivered

Pillar	2019Q3	2019Q4	2020Q1	2020-21	2021-22	2022-23
 GOVERNANCE	<ul style="list-style-type: none"> Table and approve INFC Data Strategy (includes proposal for a new high-level Governance structure) 	<ul style="list-style-type: none"> Nominate INFC data stewards¹⁹, establish Terms of Reference, and initiate detailed workplan Present detailed recommendations for expanding INFC governance 	<ul style="list-style-type: none"> Engage working groups and outreach to extend advisory body INFC data stewards to recommend progress measures and report benchmarks 	<ul style="list-style-type: none"> Assess the feasibility and role of a national data advisory body including PTMI, industry associations, and academics 		
 ENVIRONMENT AND DIGITAL INFRASTRUCTURE			<ul style="list-style-type: none"> FPT Data and Results Working Group to determine options for PT open data 	<ul style="list-style-type: none"> Define data technology architecture Explore and implement the use of cloud based Infrastructure 	<ul style="list-style-type: none"> Expand and scale the data ecosystem Pilot shared data technology for seamless data access across the infrastructure ecosystem 	<ul style="list-style-type: none"> Scale up shared and inter-operable solutions

¹⁹ Data Stewards are responsible/accountable to the organization for the quality, security, and availability of data, and for how the custodians manage the data. All staff are data custodians.

ANNEX A (cont'd) – INFC Roadmap towards ideal state

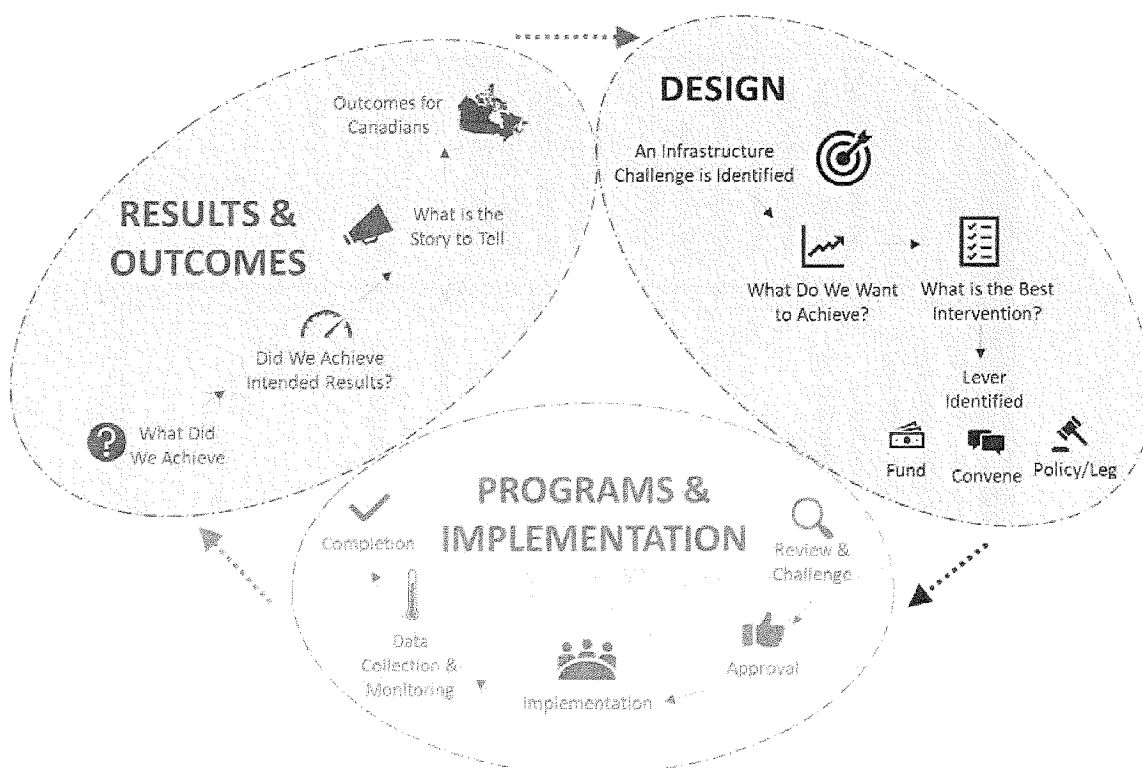
INFC Data Strategy is delivered

Pillar	2019Q3	2019Q4	2020Q1	2020-21	2021-22	2022-23
 PEOPLE AND CULTURE		<ul style="list-style-type: none"> Promote the INFC data strategy to department and announce the development of policies 	<ul style="list-style-type: none"> Data Stewards encourage data literacy and determine how work plans can better align to meet the requirements of the Data Strategy 	<ul style="list-style-type: none"> Data custodians define and adopt INFC use cases (Annex F) 	<ul style="list-style-type: none"> Pilot infrastructure and results-data decision making Work with key associations to establish a toolkit for municipalities that enables them to capture and manage core master data 	<ul style="list-style-type: none"> Establish infrastructure analytics centre of expertise
 DATA AS AN ASSET		<ul style="list-style-type: none"> Review key data challenges and establish robust data work plan INFC Data team & IMIT start Conceptual Data Model 	<ul style="list-style-type: none"> INFC Data team & IMIT finalize Conceptual Data Model 	<ul style="list-style-type: none"> Data stewards confirm and implement program Key Performance Indicators (KPIs) and add to data warehouse Data stewards assess internationally recognized data standards (e.g.ISO) 	<ul style="list-style-type: none"> Review and update the data model INFC Data Stewards determine the requirements for a digital twin Develop principles and policies for providing access to infrastructure and results data 	<ul style="list-style-type: none"> Expand INFC data model to include external data and definitions

ANNEX B – INFC's Business Landscape

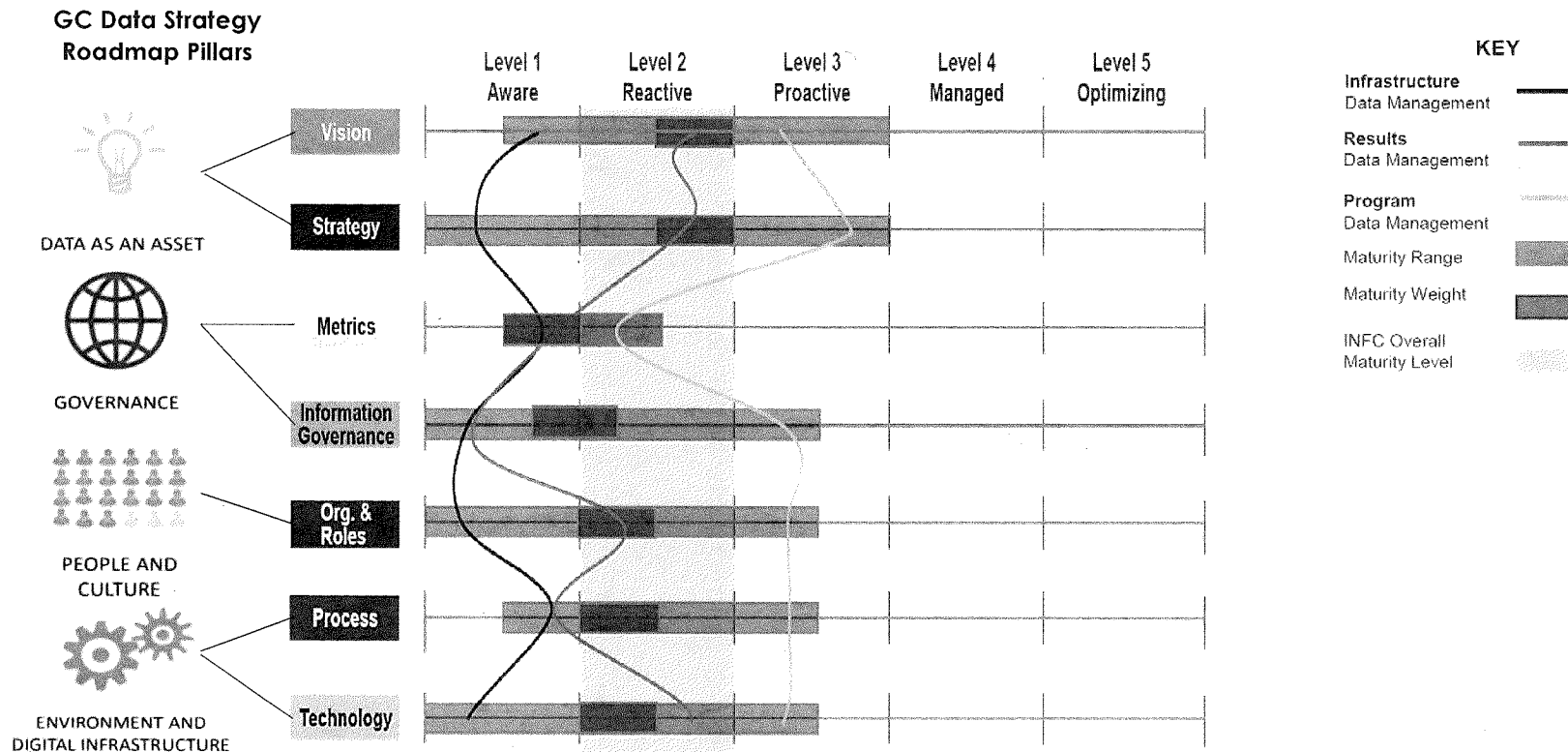
For INFC, data can inform strategic planning, policy development, advice and decision making, but can also be leveraged to better meet the needs of partners, stakeholders and Canadians to inform decisions, programs, projects and outcomes. "The Infrastructure Landscape" was developed to frame how the department thinks about the way data and research are used to make decisions and drive outcomes for the organization. The framework is grouped into three main lines of business, all of which require data and research as a support. These three main business lines are not part of a linear process, but rather reflect an outline that should be visited/revisited in a forward or backward manner, and within each phase, as required. Inserting the necessary data and research anywhere into these three main lines of business will promote the ideation of test, learn and adapt.

- *Design* – Understanding Canada's infrastructure landscape, identify challenges and determine the best intervention to address those challenges in the best interest of Canadians
- *Programs & Implementation* – Upon approval, a project is developed, launched and monitored through to completion
- *Results* – Immediate and long term impacts are measured, analyzed and outcomes for Canadians are reported on



ANNEX C – Detailed assessment of INFC Data Maturity

Gartner's assessment of INFC's Data Maturity encompasses seven domains which relate to the four pillars of the GC Data Strategy Roadmap. They conclude that a shared vision on enabling infrastructure and outcome data as assets is lacking which inhibits maturation of supporting capabilities.



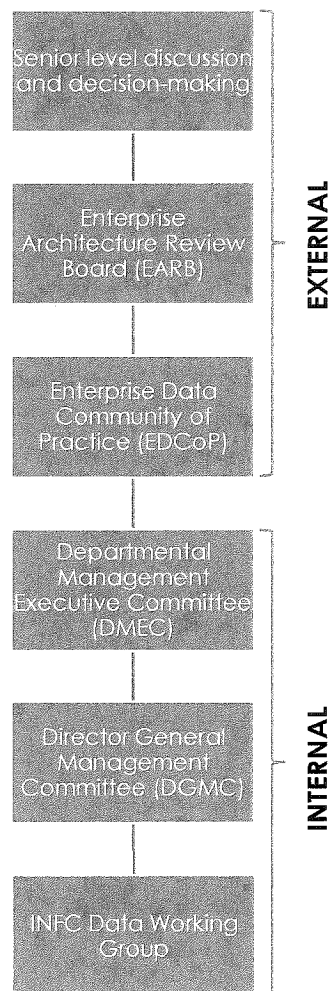
ANNEX D – Government of Canada Data Strategy Roadmap

In the Fall of 2018, the Clerk of the Privy Council released the Government of Canada's "Data Strategy Roadmap" outlining a path forward for a more strategic use of data. The goal is to set a foundation so that the Government of Canada creates more value for Canadians from the data they hold. The Roadmap identified six areas for immediate action across the federal public service:

1. Require departments to develop and implement a data strategy;
2. Ensure greater clarity on who is in charge of data;
3. Put in place standards, guidelines, and clear processes to govern how departments access, collect, safeguard and share data;
4. Clarify data governance to ensure data are managed as a public good;
5. Improve recruitment and professional development practices to ensure that departments have the skilled people to work in a digital environment; and
6. Ensure departments have the right IT environment that allows skilled professionals to use the technologies available to support the data agenda.

Organizational data strategies underpin the strategic use of data, support the transition to a digital government and ensure the public service is empowered and equipped to harness the power of data to make better decisions and create better outcomes for Canadians.

ANNEX E – INFC Data Governance Model



Data Governance at INFC will be supported by working groups and committees operating both internally and externally.

Internally to INFC, the governance structure will consider proposals and make decisions around data management that align with the departmental Data Strategy. Proposals will first be brought from the manager to the INFC Data working group, and depending on need for further direction, to DGMC then DMEC.

Externally, if proposals impact multiple portfolios, there might be a need to bring them to EDCoP – an interdepartmental committee chaired by TBS and STC, which provides policies and guidance to enable the most effective collection, storage, and sharing of data across the enterprise. In addition to this INFC will lead an inter-departmental working group to govern data needs for the *Investing in Canada* Plan, as well as participate in the broader context (Deputy Minister Task Force on Public Sector Innovation Secretariat, DM/ADM CEPP, broader inter-departmental committees to meet needs of a GC digital strategy, as required), ensuring that the INFC Data Strategy is well-represented.

ANNEX F – Using Data to Answer Use Cases

RISK ASSESSMENT	GUIDING INVESTMENT DECISIONS	DEMONSTRATING IMPACT	IMPROVING ASSET MANAGEMENT
<ul style="list-style-type: none"> • Determining the “true” infrastructure gap in Canada • Model anticipated impacts to infrastructure assets based on changes to social, economic, or environmental changes or impacts • Determining which infrastructure assets are currently, or soon will be at risk • How infrastructure assets are built/bought, maintained, and decommissioned in the future to avoid risk realization 	<ul style="list-style-type: none"> • Utilizing asset and outcomes data to inform decision making for funding allocation & Long Term Planning • Determining and maximizing “return” (impact unit — economic, social, environmental) • Modelling investment outcomes or impacts of investment decisions based on past data • Benchmarking: municipal, provincial, federal and “bright spot” identification to identify best practices or insights on infrastructure 	<ul style="list-style-type: none"> • Determine direct and indirect, social impacts, environmental impact and economic impacts of infrastructure assets and funding throughout asset life • Determine impact of infrastructure investments. • Comparing impacts by types/mix of funding: federal, provincial, municipal, private • Determining success factors of programs that yielded higher than average outcomes, and utilizing that information for future program design. 	<ul style="list-style-type: none"> • Predicting the condition and performance of transit assets, and planning budgets and activities accordingly: replacing infrastructure, maintenance of budgets, resources, and schedules • Performance analysis • Determining impact of infrastructure asset management practices on asset performance or condition • Improving tracking, planning, and modelling of maintenance activities for different asset classes of infrastructure assets such as rail cars, buses, etc. • Improve holistic view